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the company name, the company trademark, logo, etc.

Thank you for your understanding.

ROHM Co., Ltd.
April 1, 2024

ROHM GROUP
LAPIS TECHNOLOGY

ML7456N Evaluation Kit
Start Guide

Issue Date Sep 20th , 2023

ROHM SEMICONDUCTOR

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Introduction

Thank you very much for purchasing products of our company. Before using this product, please use correctly after reading this “start guide”. Moreover, please keep it carefully even after reading this.
This document provides an overview of the evaluation kit, including the steps required for Sigfox communication after the customer obtains the evaluation kit, and how to switch between various operating modes including Sigfox communication.**This document is an explanation for Sigfox communication in Japan.**

The target LSI product is as follows.
ML7456N

For the hardware specifications of this evaluation kit and the software specifications implemented in the evaluation kit, please register to My ROHM (free of charge) from the following site, and download the corresponding file to refer to and use it.

《MyROHM Login》
https://www.rohm.com/registration

《Lapis Technology Products Web site》
https://www.rohm.com/lapis-tech
Home ⇒ Wireless LSIs ⇒ Sub-GHz LSI, SoC ⇒ Sub-GHz SoC ⇒ ML7456N

(X indicates version number)

●Hardware

ML7456N Evaluation Kit Hardware Manual	**FEBT7456N_EVK_HWManual-XX.pdf**

●Software

ML7456N LWCSP and Manual	**ML7456_LWCSP_for_U16_VXXX.zip (LWCSP_System_for_U16_VXXX.chm)**
Script for Certification of Construction Type Application Note	**FEXTLWCSP_Radio_Script_XX.pdf**

For the LSI specifications of the ML7456N, please download the relevant file from our website below.

《Lapis Technology Products Web site》
https://www.rohm.com/lapis-tech
Home ⇒ Wireless LSI ⇒ Sub-GHz LSI, SoC ⇒ Sub-GHz SoC ⇒ ML7456N

ML7456N Data Sheet	**FEDL7456N-XX.pdf**
ML7414 Application Note Hardware Operation Details	**FEXL7414_AN_HW-XX.pdf**
ML7456N LSI Design Guide	**FEXL7456NDG-XX.pdf**
ML7456 Initiallization Table	**FJXT7456_InitializationTable-XX.xlsm**

Home ⇒ Microcontrollers ⇒ General-purpose MCU(16bit) ⇒ ML62Q1532

ML62Q1000 Series Users Manual	**FEUL62Q1000-XX.pdf**

Notation

Classification	Notation	Description
□ Numeric value	0x*nn*	Represents a hexadecimal number.
	0b*nnnn*	Represents a binary number.
□ Address	0x*nnnn_nnnn*	Represents a hexadecimal number. (indicates 0xnnnnnnnn)
□ Unit	word, W	1 word = 32 bits
	byte, B	1 byte = 8 bits
	Mega, M	10^6
	Kilo, K (uppercase)	2^{10}=1024
	Kilo, k (lowercase)	10^3=1000
	Milli, m	10^{-3}
	Micro, μ	10^{-6}
	Nano, n	10^{-9}
	Second, s (lowercase)	Second
□ Terminology	"H" level	Signal level on the high voltage side; indicates the voltage level of V_{IH} and V_{OH} as defined in electrical characteristics.
	"L" level	Signal level on the low voltage side; indicates the voltage level of V_{IL} and V_{OL} as defined in electrical characteristics.

□ Register description

Read/write attribute: R indicates read-enabled; W indicates write-enabled.
MSB: Most significant bit in an 8-bit register (memory)
LSB:Least significant bit in an 8-bit register(memory)

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1. Precautions of handling this product

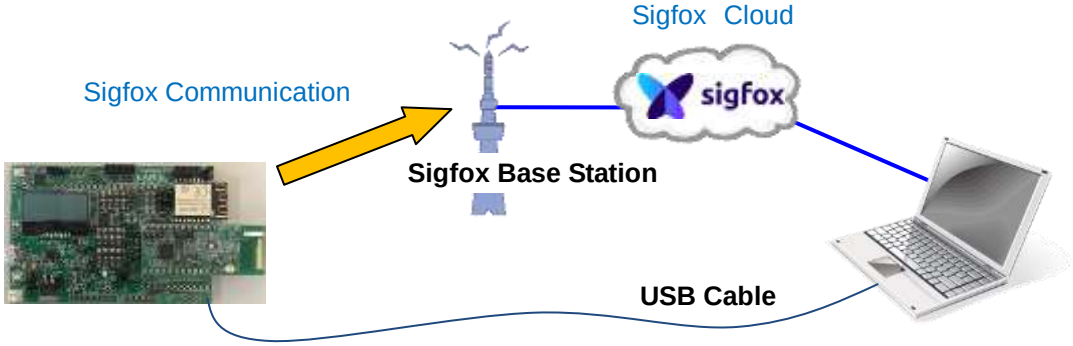
- This product is the evaluation kit. This is used for only evaluation.
- Use the application software of this product on the PC that installs the Japanese version Windows10.
- Refer the software license, then use the application software for PC and the software for MCU relating to this product.
- LAPIS Technology shall have no responsibility for remodeling and any illegal usages of our product.
- If this product emits harmful radio waves, change the frequency or stop the radio wave emittion immediately, then avoid interference.

2. Overview

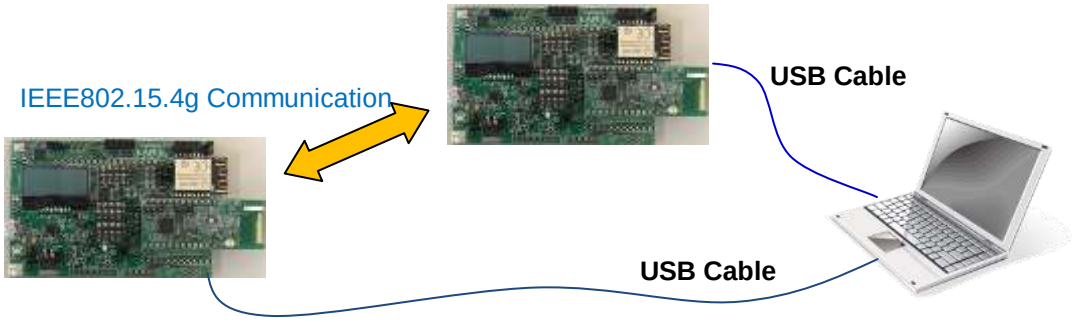
ML7456N evaluation kit (Hereafter it is written as evaluation kit) can executes various evaluation and demonstration operations by switching between multiple sample applications written in advance in the evaluation kit.
In addition, software development (use of emulator function and flash writer function) is possible by using LAPIS microcontroller on-chip emulator (EASE1000 V2).
For details on how to connect the on-chip emulator, refer to the ML7456N Evaluation Kit Hardware Manual.

This chapter provides an overview of the three operating modes: 1) Sigfox communication, 2) IEEE802.15.4g two-way communication, and 3) Sigfox periodic transmission. There is also a separate AT command application for Sigfox communication. For details, please refer to the software manual "LWCSP_System_for_U16_VXXX.chm".

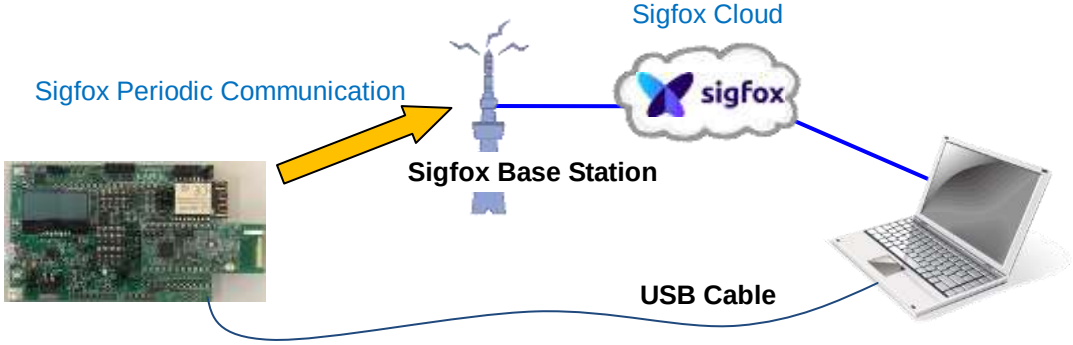
1) Sigfox Communications(Sigfox Application)
Using this evaluation kit, data can be sent to the Sigfox Backend Cloud(Hereinafter referred to as Sigfox Cloud) by control from a PC. Data uploaded to Sigfox Cloud can be easily checked on a PC.



2) IEEE 802.15.4g Peer-to-Peer Communication (Radio bypass Application)
Using these two evaluation kits, IEEE802.15.4g two-way communication can be performed by controlling from a PC. The data sent and received can be easily operated and checked on the PC.
* Two sets of this evaluation kit are required. Also, please use this operation mode when obtaining radio wave certification.



3) SigfoxPeriodic Transmission (Sigfox Periodic Transmission Application)
This evaluation kit can be used to periodically send data to the Sigfox cloud. Data uploaded to Sigfox Cloud can be easily checked on a PC. Please refer to it when developing Sigfox regular communication applications.



3. Package Contents Confirmation

Please open the box and make sure that all of the following components are available.
In the unlikely event that it is missing or damaged, please contact the place of purchase.

*Depending on the shipping time, some mounting parts may differ from the photo
(1) and (2) are connected by connectors and are integrated
Pliase prepare a PC separately by yourself.

Configuration Part	Quantity
(1) LAPIS RF Board (with ML7456N)	1
(2) Enhanced LAPIS RF Shield Board	1
(3) USB Cable (TypeA-micro B)	1
(4) User Registration Guide Document	1

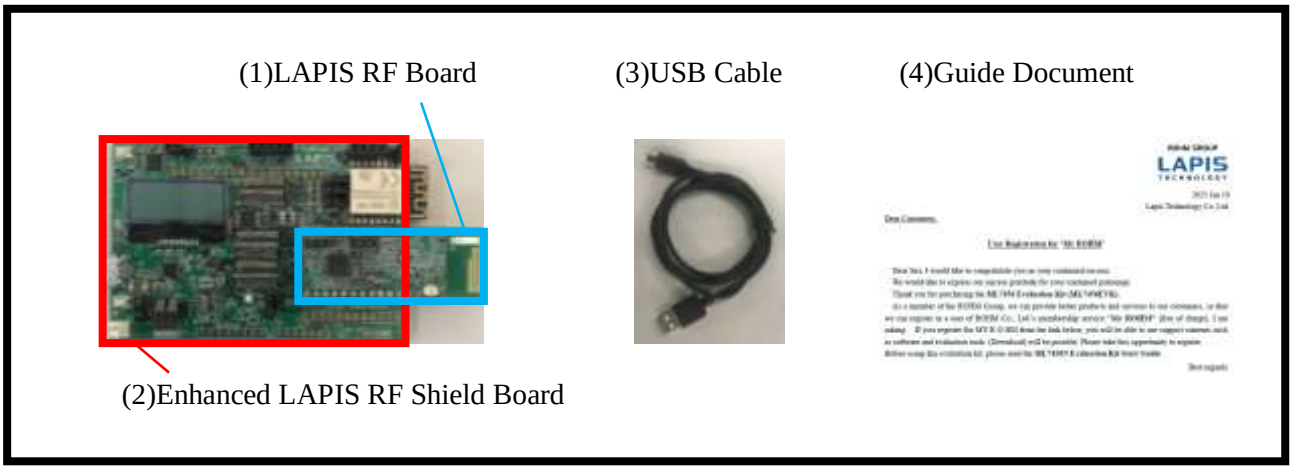


Figure 1: Evaluation Kit (Package Contents)

4. Evaluation kit appearance and USB connection

When this evaluation kit is delivered, the Sigfox communication (Sigfox bypass application) program is set to start by default.

When changing the settings of Jumper or Switch implemented on this evaluation kit, be sure to turn off the power (USB cable to PC) Please do it separately from).

For details of the specifications of this evaluation kit, please refer to the "ML7456N Evaluation Kit Hardware Manual" separately.

Plug the USB cable into the USB connector marked in red on the evaluation kit in the photo below.
【Please note】If the USB cable is inserted at an angle, there is a risk of damage to the connector.

Figure 2: Evaluation Kit (USB Cable Connection)

In addition, install the following drivers to the connected PC for USB connection.

https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers?tab=downloads
CP210x Universal Windows Driver

If you expand the CP210x_Universal_Windows_Driver.zip, you will see a file called silabser.inf and silabser.cat. In this state, please start Device Manager. CP2102N Driver? I think it is marked, so
Select the driver and double-click to open the details screen. There may be a "Update driver" button, so please press that button to update. For the driver, please specify the folder extracted above and install it.

5. Customer Preparation for Sigfox Communication

・Confirmation of device ID information
Before communicating with Sigfox, you need to activate the purchased evaluation kit on the Sigfox Buy website. Before doing so, please check the ID and PAC information of the evaluation kit.
For ⇒details, please refer to "5.1.How to read ID and PAC".

・Evaluation kit activation
In order to communicate with Sigfox,
It is necessary to purchase a line contract from Kyocera Communication Systems Co., Ltd. (hereinafter referred to as "KCCS"), the line operator of Sigfox's Japan. **For non-Japan correspondence, please contact the Sigfox operator in your country.**
⇒details can be found in Section 5.2. How to register an evaluation kit.

* If you rent an evaluation kit, you do not need to activate the evaluation kit.

5.1. Reading method of ID,PAC

ID and PAC information*1 are required to register the device to Sigfox Portal*2.
* The read ID and PAC are essential for Sigfox communication, so please back up the information so that you do not forget it.

Follow the steps below to read the ID and PAC information.

[Procedure]

(1) Use PowerSchell*3 on a Windows PC and a PC.
First, PowerSchell requires advance preparation*4.

*1: In the Sigfox network, in order to confirm that the terminal has Sigfox communication authentication, Each device has a unique identification number, which is called DEVICE ID (abbreviation = ID) and Portable Authentication Code (abbreviation = PAC).

*2: Sigfox Portal is a Sigfox site where you can register and manage Sigfox devices and check data delivered to the Sigfox cloud. (https://backend.sigfox.com/auth/login https://buy.sigfox.com)

*3: PowerSchell is an extensible command line interface (CLI) shell and scripting language developed by Microsoft to replace the traditional DOS prompt, and is a scripting environment that has been standard since Windows 7.

*4: PowerShell scripts are provided without PowerShell signing so that users can edit and use the execution policy. The initial value is set to Restricted, which prevents script execution. Therefore, in order to execute the script you provide, you need to edit the execution policy.

(2) Preparing PowerSchell (How to Change the Execution Policy)
1) Right-click the Windows PowerShell icon in the Start menu and specify Run as administrator.

2) The PowerShell console screen will be displayed, so set the following.

PS C:¥windows¥system32>**Set-ExecutionPolicy RemoteSigned**

This allows locally stored scripts to run. Also, non-local scripts (downloaded from the Internet) can only be executed if they are signed.

(3) Connect the evaluation kit to the Windows PC via USB.

(4) In order to use the command script, from the support site described in Introduction (page 2), LWCSP for ML7456N SB Please download it to the connected PC and place it in an appropriate place.

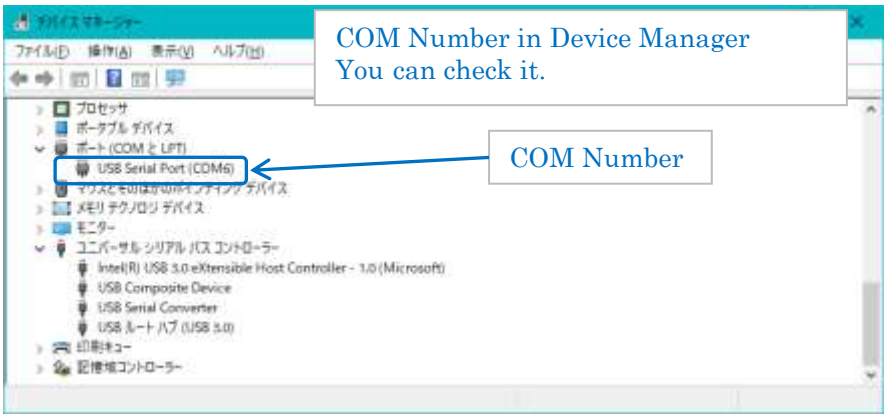
(5) On PowerSchell, navigate to the folder where the command script is located.

PS C:¥windows¥system32>**cd C:¥***¥***¥ ML7456_LWCSP_for_U16_VXXX¥script¥command**
(Please match the *** part and folder hierarchy to the location of the file you downloaded.))

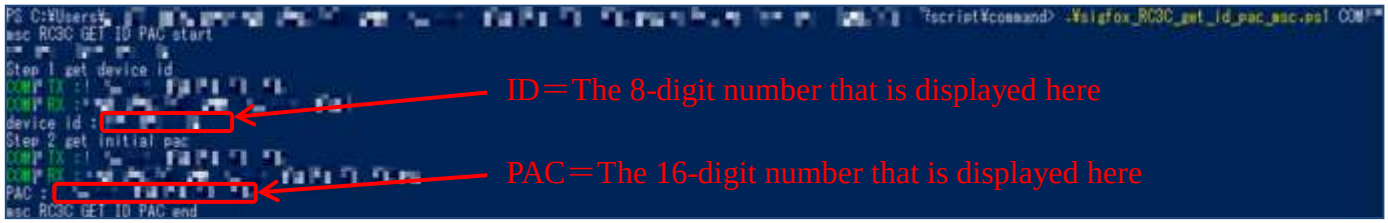
(6) In PowerShell, run the command script "**sigfox_get_id_pac.ps1**".

「. PS1" extension is a PowerShell script file. In PowerShell, the execution instructions for a script file must explicitly specify the path. Therefore, script execution in PowerShell is executed with an absolute path or with a .¥ at the beginning of a file in the current directory.

Script execution example：PS C:¥Users¥XXX¥XXX¥XXX¥script¥command>**.¥ sigfox_get_id_pac.ps1 COM***
("*" specifies the COM number to which the evaluation kit is connected.))



実行例)



5.2. How to register the evaluation kit

In order to transmit data from the Sigfox device to the Sigfox cloud, a line contract with KCCS is required when using it in Japan country.

Please refer to "Register device as a development kit (DevKit)" on KCCS's technical blog site below and complete the device registration procedure.

https://qiita.com/organizations/sigfox

In addition, if you want to apply for a line contract other than the above, it is posted on the following site of KCCS, so please apply and register as appropriate according to the posted contents.

https://www.kccs-iot.jp/buy/flow/

Reference: Approximate line charge per line ¥700~¥1,200 Device/year (as of January 2020)
Charges vary depending on the number of communications per day and the presence or absence of Sigfox Atlas (location services).

6. Sigfox Communication

This chapter describes the operations for transmitting to a Sigfox base station. In advance, see "5. Please check and configure the contents described in "Advance preparation for Sigfox communication".

6.1. Data Transmission Method to Sigfox cloud

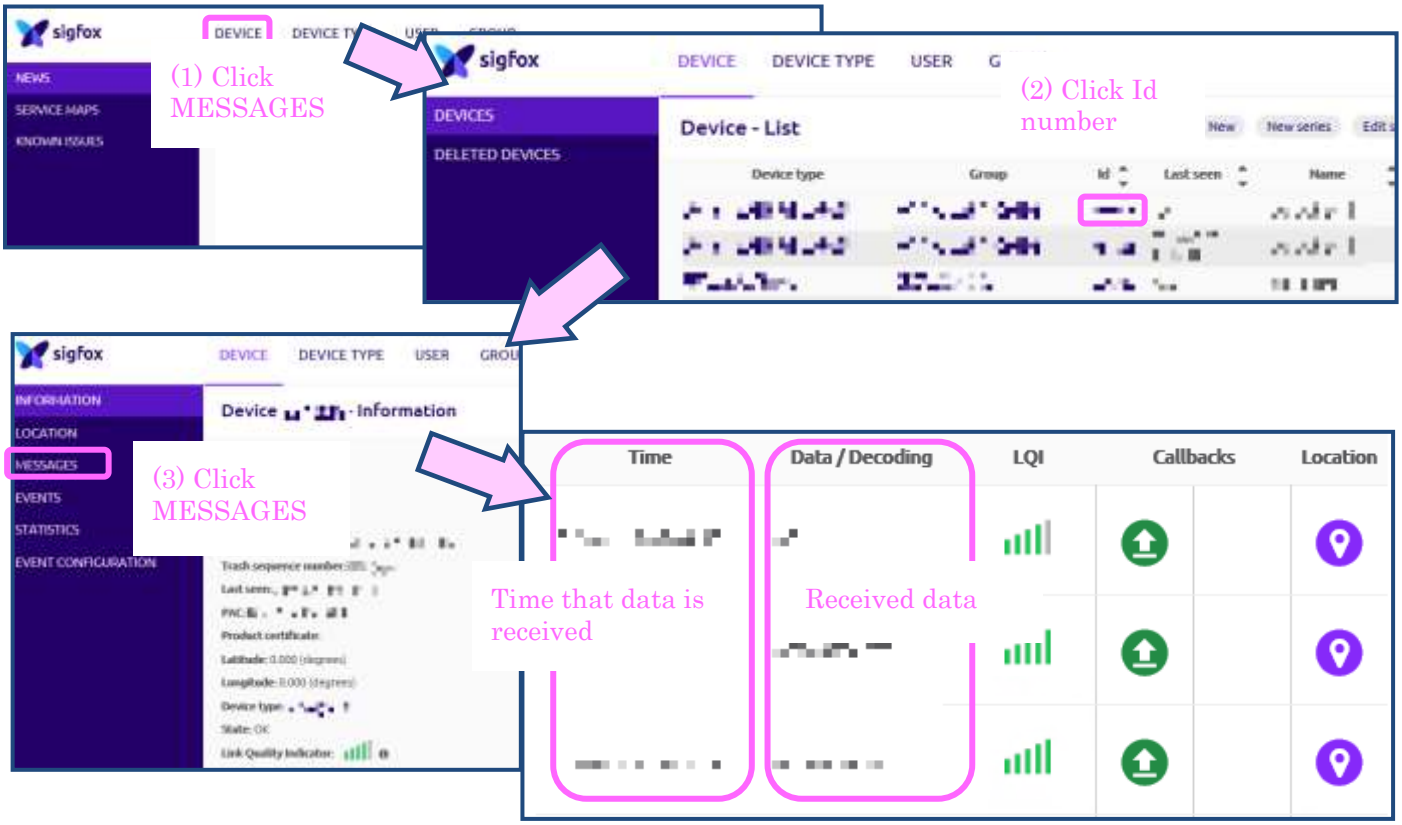
In PowerShell, run the command script "sigfox_xxxx_send_frame_msc.ps1".
Script execution example：PS C:¥Users¥XXX¥XXX¥XXX¥script¥command>.¥ sigfox_xxxx_send_frame_msc.ps1 -rc_mode 3 -com_name COM*
("*" specifies the COM number to which the evaluation kit is connected.))

Example execution response)

```
Get rc_mode parameter
com4 : 01FF0600020201FF000403
com4 : 02FF1600020201FF000403000000FFFFFFFFFFFFFFFFFFFFFFFF03
get rc_mode number: 3

msc RC3C SEND FRAME start
Step 1 open
com4 : 017F0500000200000303
com4 : 027F0600000200000000003
Step 2 set std config
com4 : 017F11000502000002000000640000000000000000103
com4 : 027F0600050200000000003
Step 3 get version
com4 : 017F05000A0200000003
com4 : 027F13000A020000000000C0056322E31302E305F46444C03
Sigfox Library Version : [illegible]

Step 4 send frame
com4 : 017F1400020200000C020000303132333435363738393A3B03
com4 : 027F0800020200000000000003

Step 5 get info
com4 : 017F05000B0200000003
com4 : 027F0700000B02000000000B03
Information : 0B

Step 6 close
com4 : 017F04000102000003
com4 : 027F0600001020000000003
msc RC3C SEND FRAME end
```

6.2. Confirmation Method of Sigfox cloud

S Device management and data confirmation that is registered to Sigfox service is done on the Sigfox Portal (https://backend.sigfox.com/auth/login)*6 . Please complete device registration that is introduced at the previous page, transmit data, then confirm the data on it.



*6: Sigfox ID is necessary to login the Sigfox Portal. It can be produced in the procedure of KCCS line contract.

7. Switching Operation Modes

In this chapter, 1) Sigfox communication, 2) IEEE802.15.4g peer communication, and 3) Sigfox periodic transmission. Describes how to switch between sample application types. Each of these modes of operation allows the following sample applications to be configured as startup software:

1) Sigfox communication Sigfox	bypass application
2) IEEE802.15.4g	Coupled Radio Bypass Application
3) Sigfox Periodic	Transmission Sigfoxte Periodic Transmission Application

These sample applications can be modified from PowerShell with **syscmd_set_start_app_number.ps1** scripts. After setting the desired startup software in PowerShell, resetting will launch the specified sample application.
* The factory default of this evaluation kit is set to operate the Sigfox bypass application.

■How to switch between sample applications
(1) Launch PowerShell.
(2) On PowerSchell, navigate to the folder where the command script is located (¥***¥***¥script¥command).
(3)In PowerShell, run the command script "**syscmd_set_start_app_number.ps1**".

Sigfox bypass applications:**.¥syscmd_set_start_app_number.ps1 -app_number 0 -com_name comXX**
Radio bypass applications:**.¥syscmd_set_start_app_number.ps1 -app_number 1 -com_name comXX**
Sigfox periodic transmission applications:**.¥syscmd_set_start_app_number.ps1 -app_number 2 -com_name comXX**

【Execution example】

```
¥command> .¥syscmd_set_start_app_number.ps1 -app_number 1 -com_name com
System Command SET_EEPEM( Start Application Number )
com   : 01FF090001020IFF000501000103
com   : 02FF050001020IFF0003
10
```

■How to review the sample application

You can check if the desired sample application is set up by using the **syscmd_get_start_app_number.ps1** script from PowerShell.

.¥syscmd_get_start_app_number.ps1 -com_name comXX

【Execution example】

```
¥command> .¥syscmd_get_start_app_number.ps1 -com_name com
System Command GET_EEPEM( Start Application Number )
com   : 01FF060002020IFF000503
com   : 02FF160002020IFF000501FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF03
27
```

Response

Revision History

Document No.	Date	Page		Note
		Before	After	
FEXT7456N_ startguide-01	2023.1.23	–	–	Initial release
FEXT7456N_ startguide-02	2023.3.10	3	3	ULR update for "MyROHM Login" Added "Script for Certification of Construction Type Application Note" Added "ML7456N LSI Design Guide" Added" ML7456 Initiallization Table"
		7	7	AT command application description added Updated file names in software manuals Sigfox Cloud official name (Sigfox Backend Cloud)
		9	9	Added USB driver installation description
		11	11	Added backup description to "How to read ID and PAC"
FEXT7456N_ startguide-03	2023.9.20	3	3	Lapis Technology Products Web site update
		14	14	Script execution example update